The Bridge Preservation and Repair Plan for Calendar Years 2009- 2011

Respectfully submitted by the Structurally Deficient Bridge Improvement Program Coordination and Oversight Council to the clerks of the House of Representatives and the Senate, the Joint Committee on Transportation, the Joint Committee on Bonding, Capital Expenditures and State Assets and the House and Senate Committees on Ways and Means in accordance with section 19(a) of Chapter 233 of the Acts of 2008.

Introduction

Following on a pledge to repair the Commonwealth's most neglected bridges, Governor Deval Patrick, on May 13, 2008 filed legislation to accelerate the repair and replacement of bridges controlled by the Massachusetts Highway Department (MassHighway), owned by cities and towns, or controlled by the Department of Conservation and Recreation (DCR). The bill was enacted by the Legislature and signed into law on August 4, 2008 as Chapter 233 of the Acts of 2008.

Due to decades of neglect, more than 500 bridges controlled by MassHighway and DCR or owned by cities and towns are classified as structurally deficient. At current funding levels, left unchecked, that number would increase to close to 700 structurally deficient bridges in the next eight years.

The Accelerated Bridge Program (Program) will repair bridges across the Commonwealth that are currently structurally deficient or would otherwise become structurally deficient during that time period. Instead of seeing the number of structurally deficient bridges increase by approximately 30 percent over the next eight years, the number will be reduced by approximately 15 percent during that time. Major bridge repair projects across the state will be accelerated, including the Longfellow Bridge over the Charles River, the Fore River Bridge in Quincy, the Whittier Bridge in Amesbury and the Route 9 Bridge over Lake Quinsigamond in Shrewsbury and Worcester, as part of the Program.

Building upon the lessons learned from the Central Artery Project, accountability to the state will be a core principle of the management plan. Included among the steps being taken to accomplish this objective is that the management of the Program will be overseen by state officials to ensure accountability for timely and cost efficient work. These steps will be summarized in a project controls report to be submitted to the Legislature later this month.

As required by section 19(a) of the Act, this report provides cost estimates and scopes of work for specific bridges for calendar years 2009 through 2011 and also for all bridges requiring multiple years to be completed, plus annual key milestones.

Two lists of bridges in the Program, one sorted by projected advertisement date, and one sorted by municipality, are attached to this report as Exhibit A and Exhibit B, respectively.

Accelerated Bridge Program Overview

Chapter 233 of the Acts of 2008 (Act) created the Program, providing approximately $3 billion for the design and construction of Commonwealth and municipal bridges. The goals of the program as defined by the Patrick-Murray Administration are to:

- Improve the safety and condition of bridges in the Commonwealth, with a particular focus on structurally deficient bridges and on bridges projected to become structurally deficient in the next eight years, so that by the end of the Program the number of structurally deficient bridges will be approximately 250 fewer than would be the case under existing revenue streams;

- Create thousands of construction-related jobs and maintain the critical infrastructure necessary for the long-term economic growth of the Commonwealth; and

- Generate significant cost savings by accelerating projects now, thereby avoiding construction cost inflation and cost increases due to deterioration caused by deferred maintenance.

Approximately $2.1 billion under the Act is allocated to MassHighway for bridges under its control or owned by cities and towns, and approximately $900 million is provided to DCR for bridges under its control. Expenditures will occur over a period of eight years and conclude on or before June 30, 2016. In order to meet this schedule, project advertisement is expected to occur primarily in the first four years of the program and be fully complete by June 30, 2013. This level of spending will require the agencies to nearly double their combined production efforts. Put another way, the level of accelerated bridge projects advertised on average over each of the next four years ($547 million) will approximate the agencies' combined road and bridge program for 2008 ($590 million).

Background on the Problem

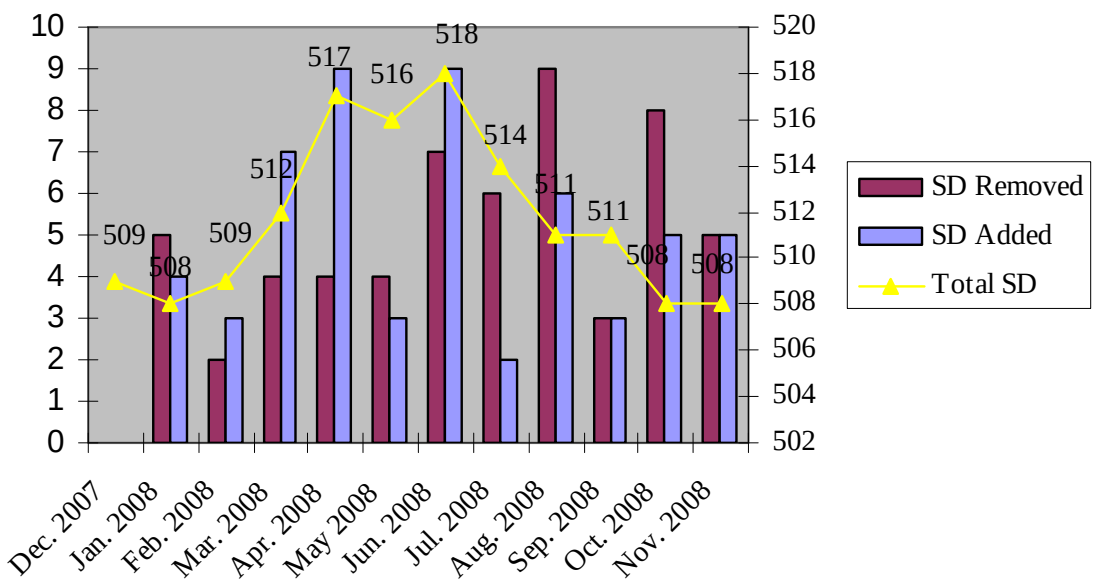
There are 4,521 bridges that are eligible for funding under the Program – 2,857 are controlled by MassHighway, 1,551 are locally owned, and 113 are controlled by DCR.

As of the Program's inception in May 2008, approximately 543 of these structures were structurally deficient.[1]

Based upon the age and deterioration rate of the Commonwealth's infrastructure, it is projected that the level of structurally deficient bridges would increase to 697 in the next eight years if funding were maintained at historic levels. The goal of the Program is to reduce that number to 450, while saving money in the long run by fixing bridges earlier thereby saving costs attributable to inflation and additional deterioration due to deferred maintenance. In order to accomplish this goal it is necessary to fix a significant number of structurally deficient bridges, while simultaneously repairing other bridges to keep them from declining into structural deficiency, and it is necessary that the agencies conduct this work in an expedited manner.

Figure 1 illustrates the reason why increased investment is so critical to reducing our inventory of structurally deficient bridges. Under current spending trends, for each structurally deficient bridge that is repaired, another bridge slips into structural deficiency. In order to address this trend, the Commonwealth needs to repair or replace approximately 2.1 bridges to achieve a net decrease of one structurally deficient bridge.

Figure 1: MassHighway SD Bridge Trend (2008)



[1] As of the date of this report, the number of structurally deficient bridges in the Commonwealth eligible for work under the Program is 537.

Types of Bridge Projects

Bridge projects can be classified into three basic types – preservation and maintenance, betterment and partial rehabilitation, and replacement and full rehabilitation.

Preservation projects are performed on bridges that are generally in acceptable condition, but have some problems that have been identified through regular bridge inspections. Preservation projects are intended to address these relatively minor deficiencies before they have a chance to grow into major problems requiring more costly work. Preservation is a cost effective means of keeping bridges in a state of good repair and extending their service life. Examples of this type of work include painting, joint repairs, and deck, superstructure, and substructure repairs. Bridge preservation work is less expensive and generally takes less time than rehabilitation and replacement work, requires limited or no design, right-of-way, and environmental permits, and offers the best opportunity to bundle several bridges of similar need together in one contract to expedite delivery of projects under the Program. It also is a wise investment that has been shown, over time, to be an effective way to maintain healthy bridges.

Betterment and minor rehabilitation is performed on bridges to repair or replace individual components that have deteriorated sufficiently to cause the entire bridge to be rated structurally deficient or, in some limited cases, where the components are not yet deficient but are nonetheless sufficiently deteriorated to require significant repair or replacement rather than preservation. An example of this type of project would be a deck replacement or major superstructure or substructure repairs. Betterments and minor rehabilitation projects require limited design services, typically involve little or no right-of-way or environmental permits, and may offer some opportunity to bundle projects or use other innovative project delivery techniques, such as design/build or installing pre-engineered, pre-fabricated components.

Structurally deficient bridges undergo replacement and full rehabilitation when the structural adequacy of more than one of the major components is such that it needs significant repair or replacement. On occasion, MassHighway will replace a bridge that is not structurally deficient; this is only done when replacement is more cost effective than rehabilitation or when replacement is needed due to functionality issues. DCR bridges are typically heavily traveled, complex structures that have historical and cultural significance, are uniquely designed to complement the surrounding parks and parkways, and have many demands from heavy bike and pedestrian traffic that must be included in the project considerations. DCR is, therefore, constrained in its scope to rehabilitate rather than replace these structures wherever possible to maintain the historical and cultural character of its bridges. Replacement or major rehabilitation is significantly more complex than other types of bridge projects. It requires full design services, including the submittal and review of bridge sketch plans, preliminary bridge designs and final bridge designs, as well as 25%, 75% and 100% approach (roadway) designs, may require right-of-way and environmental permits, and offers limited opportunity for bundling projects.

Developing the 2009 - 2011 Bridge List

Developing a plan to double the capacity of MassHighway and DCR to deliver public works projects has been an aggressive and thought-provoking venture that has challenged the agencies to rethink existing processes and to work together to chart a new course. An interagency coordination director has been established at the Executive Office of Transportation to support the role of the Oversight Council in facilitating communication and coordinating efforts between MassHighway and DCR. Staffing plans have been developed and are being implemented to bring on-board the necessary engineers and program staff to get the job done. Close to three hundred personnel will be hired by the agencies, augmented by contractors where appropriate. Fourteen consulting contracts have been procured to bring the designers on-board in advance of final project selection to expedite design. New techniques and program controls have been developed and will be applied. These controls will involve new reporting and electronic project tracking against benchmarks with quality control personnel in the field, as well as in the central agency offices.

The project selection criteria for the Program are based upon a continuous, ongoing prioritization effort. The underlying basis for these criteria is the condition of the bridges based largely on information gathered through the Bridge Inspection Management System. Bridges in Massachusetts are inspected at a minimum every two years, with more frequent inspections provided based upon condition if warranted. The inspection examines various structural and functional aspects, but focuses primarily on the condition of the deck, the superstructure (beams supporting the deck), and the substructure (piers and abutments). Each of these components is rated on a scale from zero to nine, with zero representing a failed condition requiring bridge closure and nine representing an excellent condition usually resulting from recent construction.

A bridge is rated as structurally deficient when the combination of these components (deck, substructure and superstructure) have measurably deteriorated to the point at which action is needed or when any individual component is rated at four or below (4 = poor, 3 = serious, 2 = critical, 1 = imminent failure, and zero = failed). These bridges are then prioritized for repair based upon the seriousness of the structural problem, the structure's regional and local importance, geographic equity and cost and budgetary considerations. In addition to these structurally deficient bridges, the agencies also strive to appropriately maintain and preserve other bridges so that they do not fall into structural deficiency. One final factor that must be considered is each project's relative level of difficulty, since one of the overarching requirements of the Program is that all projects be completed within eight years.

The bridge list was developed from a combination of data analysis and professional judgment. It began with an assessment of existing bridge conditions and projected deterioration rates. The selection of candidate projects reflected the Program's primary goal of reducing the number of structurally deficient bridges, as well as improving overall bridge health, and resulted in a mix of replacement, rehabilitation and preservation

projects. This approach provides the most cost effective method of improving bridges in the Commonwealth.

MassHighway Controlled and Municipally Owned Bridges

To develop its portion of the list, MassHighway first examined a list of major bridge projects that previously could not be pursued due to a lack of funding. Based upon an analysis done at the inception of the Program in May, it was estimated that as much as $800 million of accelerated bridge funding should be dedicated to a small number of critical bridge projects.

MassHighway then analyzed the list of over 500 structurally deficient bridges within the purview of the Program. In order to ensure that Program funds would be used to accelerate projects, this list was culled to eliminate bridges currently under construction or scheduled for construction in 2009 using previously identified funding. The remaining bridges were then prioritized based upon four primary factors: average daily traffic, fracture critical issues (risk of a single point of failure due to a lack of structural redundancy); scour issues (substructure deterioration due to water flow); and District priorities. This analysis resulted in a list of over 200 candidate structurally deficient bridges.

The analysis also involved an assessment of system preservation and maintenance needs based on MassHighway's bridge management system, informed by input from MassHighway District, Maintenance, and Bridge units. MassHighway, like most states, uses the Pontis bridge management system to help determine system level bridge needs. Using bridge inventory data, Pontis can be used to forecast bridge life-cycle deterioration rates and costs and formulate system preservation, replacement, and maintenance needs. MassHighway personnel review Pontis outputs and confirm or adjust the recommendations as needed to reflect on-the-ground realities.

DCR Controlled Bridges

To develop its portion of the list, DCR reviewed its inventory list of structurally deficient bridge projects that were unfunded in its five-year capital plan. Structurally deficient bridge projects from the five-year capital plan that met the criteria of the program – construction start within five years and construction completion within eight years – were immediately included in the Plan. DCR further evaluated structurally deficient projects that did not immediately meet the schedule criteria of the program and, where possible, project schedules were accelerated and synchronized to meet the schedule criteria of the program and added to the list.

DCR additionally analyzed its inventory of critical bridge projects that are not structurally deficient to determine the rate of deterioration over the duration of the program. This analysis utilized available inspection and rating reports, site visits, and average daily traffic flow. A schedule analysis was also performed to determine if the initial or accelerated project schedule would fit within the duration of the Program.

Critical bridges were then added to the list as major preservation projects where the project schedule fit and the deterioration rate was determined to put the bridge into a structurally deficient category within the duration of the Program.

The results of the agencies' analyses were refined through several iterations to develop their respective portions of the Program. These iterations were primarily based upon ongoing assessments of individual project readiness, complexity, costs and schedules.

DCR and MassHighway's project lists have been combined to create the 2009 - 2011 Bridge Preservation and Repair Plan. As required by the Act, the list includes bridges for which spending will be made during these initial three years, but which will not be completed until later years of the Program. Because of this requirement, all bridge candidates for the Program are included in the list. As noted below, the list will be reviewed and updated annually and may be modified based on particular progress that s achieved.

Based on agency expertise, a common program has been achieved. Each agency has selected landmark projects that have not been funded under annual bond caps, has maintained a focus on structurally deficient bridges, and has provided an increased level of funding for an ongoing preservation and repair program to improve bridge health at the least cost to the taxpayers.

A Summary of the Program

The Program strikes a balance between replacement, rehabilitation and preservation. The focus of the Program is structurally deficient bridges. It will result in a significant reduction of the number of structurally deficient bridges and improve the overall health of bridges in the Commonwealth.

The Program has made it possible for both agencies to assess their bridge needs and develop a systematic plan of action. Table 1 provides a brief overview of the Program.

Table 1 – The Accelerated Bridge Program at a Glance (Construction Cost Only)

	Number of Projects	Number of Bridges	Estimated Cost	Percentage of Cost
Total Program	192	590	$2,211,000,000	100%
Site-Specific Projects	156	235	$2,002,000,000	91%
Preservation Program	36	355	$209,000,000	9%
DCR Program	32	85	$733,000,000	100%
Site-Specific Projects	31	35	$633,000,000	86%
Preservation Program	1	50	$100,000,000	14%
MassHighway Program	160	505	$1,478,000,000	100%
Site-Specific Projects	125	200	$1,369,000,000	93%
Preservation Program	35	305	$109,000,000	7%

Note 1: Site-specific projects include both replacement and rehabilitation of structurally deficient bridges and preservation of identified structures to keep them from becoming structurally deficient. The total number of

structurally deficient bridges being addressed by the Program is 135: 111 under the MassHighway portion and 24 by DCR.

Note 2: The Bridge Preservation Program will be undertaken in a corridor or districtwide approach. Bridges are typically addressed under this program based upon relative need and the scope of work required. The number of bridges included in the preservation program is an estimate based upon historic trends and preliminary engineering estimates. The actual number of bridges may vary.

Ongoing Project Development

As noted earlier, selecting the projects for the Program involved multiple types of analysis. This analysis has been limited by the data available between the inception of the program in May and this report in November. Over time, as additional staff and data are available and projects are moved farther along in development, additional information will refine the choices made, and as required by the Act, the list will be updated annually. Many issues will continue to evolve over time, but perhaps none more than cost estimating and project scheduling. Of necessity, many of the projects included in the Program are based upon a system-level analysis that can only be refined through additional iterations as more project-specific information is developed.

Scoping and estimating generally starts with an in-depth evaluation of the structure. This process consists of one or more site visits. If required, material testing may be performed to assist in the evaluation process. Once an evaluation is completed, an initial scope is developed. Based upon this scope, a preliminary cost estimate is determined based upon industry standards and historic and trended cost information. This preliminary cost estimate is refined throughout the design process.

The process of developing project cost estimates and a schedule for the Program also has several stages that will continuously be revised over time. In reviewing these cost estimates and those in subsequent annual lists that the Council will submit, it is necessary to understand the stage of each project in order to interpret the reliability of the estimate. As will be documented in the Council's upcoming "Project Controls" report, greater confidence can be placed in estimates and schedules at the later stages of the design. All information presented in the Plan is based on the best available data at the time this report was generated.

While the Council will monitor early programmatic milestones, including expediting project scoping and the development of improved conceptual estimating formulas, it is important to reinforce that each review will be based on the best available data at that time and subject to change over time. In light of this, several contingencies have been anticipated and included such as recent inflation rates, schedule drivers (i.e. permitting, right-of-way, sequencing, utility removal, etc.), historical agency performance in similar projects, performance goals aimed at accelerating future project delivery, project size and complexity.

Conclusion

The Accelerated Bridge Program will enable the Commonwealth to realize several important benefits. The lack of adequate funding for the health of critical infrastructure

has taken its toll on Massachusetts bridges. This financing, coupled with the intense focus on innovation and improved project delivery, will truly maximize the public's investment. One month after the funding for this initiative was put in place, there is substantial progress on specific projects and future projects are being scoped and design planned at an accelerated pace. In the coming weeks a new set of project controls will be introduced advancing important data-driven performance measures not only for the Accelerated Bridge Program but throughout the all of the agencies' road and bridge programs. Over time, it is anticipated that the specific dates and deliverables on this plan will change as projects are further developed, cost estimates are refined, and schedules are better defined.

To enable programmatic success in light of the complex variables involved in designing a program of this size, the Accelerated Bridge Program is built on the principles of transparency and accountability. Throughout the life of the Program, the Council will closely monitor and report on progress.